Investigating Plant and Animal Zonation on the River Gann Estuary

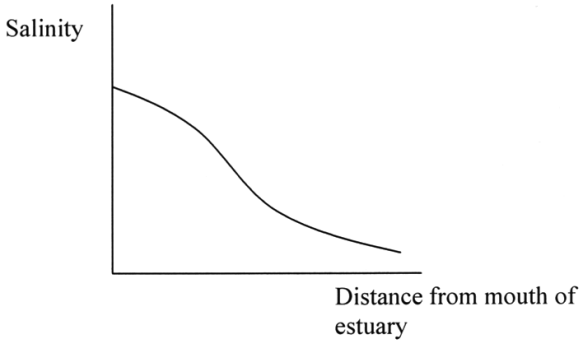
AIM

Our aim is to find out the extent of zonation on an estuary. The estuary was that of the River Gann in Pembrokeshire, West Wales.

HYPOTHESIS

Salinity is expected to decrease as we travel further inland up the estuary as this is farther from the sea, and therefore receives less saline input. Also, the further from the input of salt-water, the closer you are to the source of fresh-water input.

From this, we can predict that plan and animal zonation will reflect the tolerance of salinity, meaning that we expect that we find different species at different sites along the estuary. This is because very few species of any animal can tolerate a limited range of salinity; plants also share this characteristic. Therefore, we expect the salinity to look like the graph below:

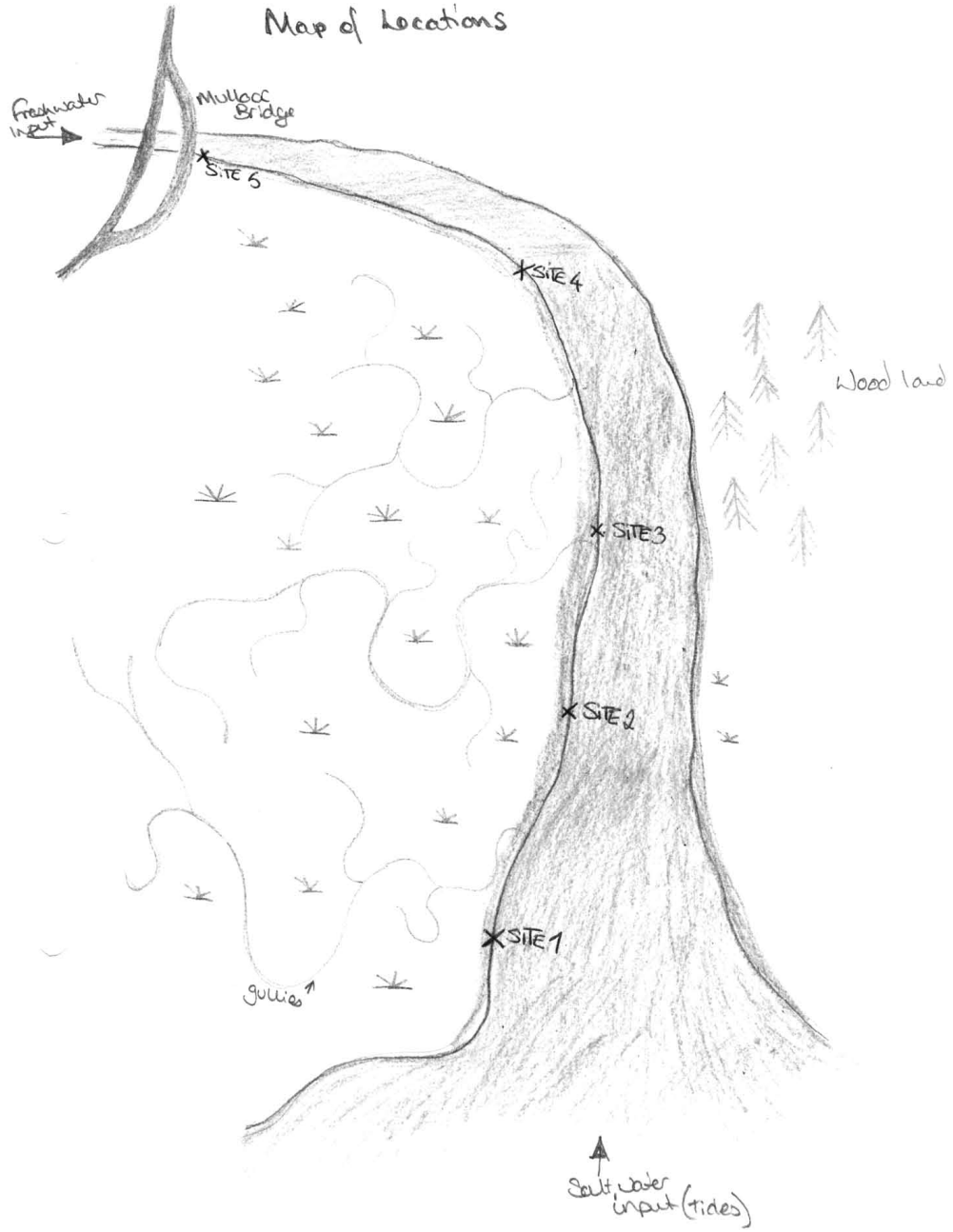


PROCEDURE

There were five methods of measurement performed at each site. One method would be carried out by one group and the clipboard and method passed to the next to perform at the next site. The methods were:

1. **Grab**; An Eckman grab was used to take soil samples from each site, normally about one metre from the shore.
2. **Kick**; Two people swept the bottom of the river with nets, trapping as much sediment as possible. This was then emptied into a tray and the animals caught were recorded.
3. **Physical**; A pHOX meter was used to record the salinity, pH, turbidity, oxygen presence and conductivity of the water at each site. This was placed about one metre from the shore.
4. **Flow**; A flow meter recorded the number of revolution per 50 seconds which indicated how fast the flow was. An average was taken from three readings at each site

Example 3


Map of Locations
Freshwater input
Mullaoc Bridge
SITE 5
SITE 4
Wood land
SITE 3
SITE 2
SITE 1
gullies
Salt water input (tides)

5. **Quadrats**; half metre quadrats were placed across the estuary and the percentage cover of the seaweeds were taken and the averages taken from these readings.

Also, a seine net was dragged at sites 1, 2, 3 and 4 and the animals counted from these readings

RESULTS

Table 1: pHOX Physical Data

Site	**1**	**2**	**3**	**4**	**5**
Salinity (*ppt*)	24.4	20.1	4.5	0.7	0.1
[O_2] (mgl^{-1})	6.6	7.4	-	11.5	-
[O_2] (% *saturation)*	8.0	82	92	105	88
Conductivity (*mhos*)	38100	32700	5400	1250	550
pH	8.1	8.1	80	8.05	8.0
Temperature (^oC)	9.7	8.8	11.3	12.0	9.9
Turbidity (*n.t.u.s*)	70	70	360	110	190

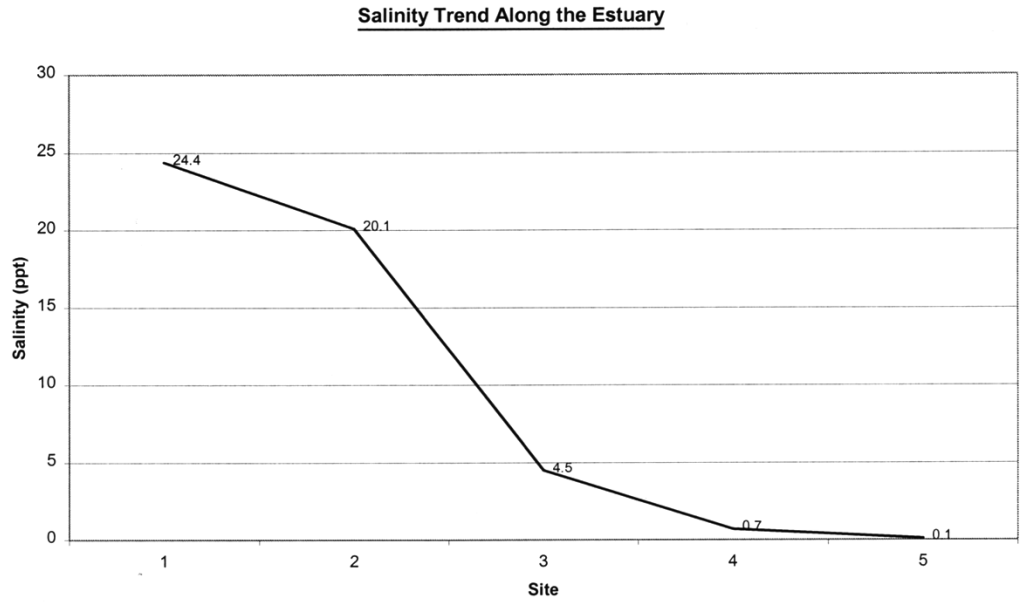


Table 2: Animal Data from Sweep Nets

Site	1	2	3	4	5
Flounder	1				30
Gammarus locusta	5				
Common Prawn	2	2			
Corcinus meanus	1	5			
Monogamurs	1				
Pipe Fish	1				
Spheroma	1				
Hydrobia	3	2			
Gammarus dubenii		1			
Sand Smelt		1			8
Gammarus pulex					20
Chironomod Larva					11
Potomapyrgus					18

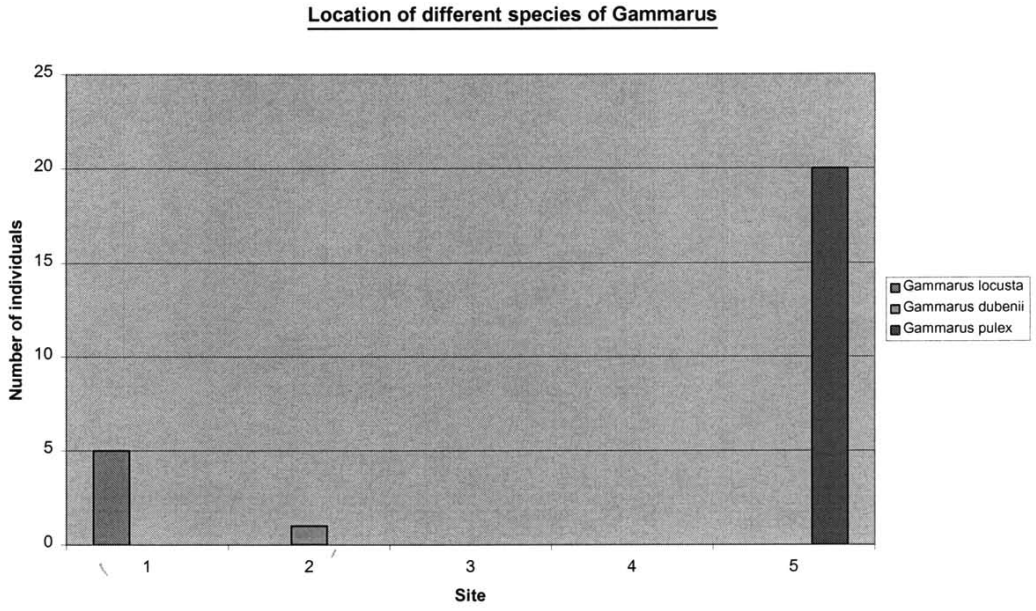


Table 3: Animal Data from Seine Net

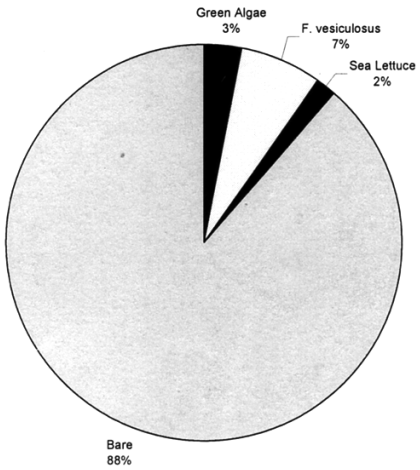
Site	1	2	3	4
Corcinus meanus	10	26	104	13
Sand Goby	61	91	21	16
Common Prawn	4	4	6	36
Common Shrimp		2	10	
Opossum Shrimp	67	18		29
Flounder				12

Table 4: Plant Data from Quadrats

Site	1	2	3	4	5
Green Algae	3				
F. vesiculosus	6.75				
Sea Lettuce	1.5	1.25	4		
Gut Weed					40:4

Chart to show the plant coverage at site 1 and 5

Site 1



Site 5

DISCUSSION

Our results supported our hypothesis that salinity decreases as you travel further upstream; the graph shows a strong decline as in site 1, nearest the sea, the salinity was nearly sea water (22.4*ppt* to 32*ppt*) where as site 5, which was farthest upstream had a salinity of 0.1*ppt* which classifies it as freshwater. It was not a steady decrease however, as there was a significant decrease between sites 2 and 3, suggesting that salinity does not decline steadily throughout the estuary. Our zonation prediction was also supported by the fact that we observed distinct preferences in location for several animals. The best examples are the gammarus species; three types of gammarus were found, gammarus locusta at site 1, gammarus dubenii at site 2 and gammarus pulex at site 3 each in a separate part of the estuary. This shows a clear zonation of species and is a clear example of different levels of preference and toleration of salinity. The other example are the two types of similar snails we found; hydrobia at site 1 and 2 and potomapyrgus at site 5 which also shows that the hydrobia favours saltier conditions than the similar potomapyrgus. As these two species are closely related, this is a clear example of location according to salinity tolerance. Also, there were no types of plant or animal found at every single site, although many were found in more than one, such as the common crab but preferences were established, showing that salinity varied between sites.

However, despite this support, there was much that we could have done to improve the investigation and improve the accuracy. It would have been better if one group had performed one method at each site. This would have meant that the exact same method was being performed and create a fairer test and equalised the sampling effort. Also, each method could have been carried out at least twice more at each site, and an average taken. This would have reduced the risk of wrong data. Perhaps more sites could be introduced in a future investigation, to further define the stages of the estuary. Ideally, if we had more equipment and more people, they could be positioned at each site so the experiments were carried out at the same time as an estuary is constantly changing, which means that our results might not be as exact as we would like.

However, we did observe that sometimes, the location of a species does not always depend on the salinity. Our most signifigant example of this is the gut weed found at site 5. This is normally a salt-water plant yet was found only in the freshest water we recorded. This apparent anomaly can be explained by the bed material; at site 5 there were fallen rocks from the bridge which the gut weed could establish itself upon. At the other sites, the bed was just mud and so there was no anchor for the gut weed. Also, the flow was different at the sites, which could affect the communities. For instance, the flow was fastest at site 5, which is what we expected, yet this could also affect the type of plants and animals which established themselves as opposed to the slow flow at site 1 where the river meets the sea. These differences show us that the different types of community you find in an estuary are not just dependant on salinity, but more complex.